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**PLC Applications**

Module 5: Projects



PREPARED BY

**Academic Services Unit**

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Module 5: Projects

**Module Objectives**

Upon successful completion of this module, students will be able to:

* Analyze a control task that uses digital and analog inputs and identify its major control elements.
* Develop and implement a simple PLC control application.
* Solve a real life control problem using LOGO! Controller.
* Troubleshot and check ready made PLC programs.

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| **5.1 Introduction**  Any control application can be implemented in the traditional methods using Electrical circuits and wiring. Although these solutions have been  in use for a long time and are still in use, the PLC solutions are replacing  these old systems because of the following reasons:   * PLC reduces the wiring hassles * PLC provides high flexibility in modifying control process. * PLC makes troubleshooting much easier   In this module, students are required to select a project from the list below, design and build it using his/her imagination and creativity. The project specifications listed in the module are the minimum requirements, and students are free to modify or add more to the specified design.  At the end of the project, students should submit a short report outlining their design.  **5.2 Monitoring water temperature**  A heater is used to heat water, while a thermistor is used to monitor the water temperature, the graph below shows the relation between the resistance of the thermistor and its temperature:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | | Resistance Ω | Temp C | | 2400 | 25 | | 1950 | 30 | | 1630 | 35 | | 1370 | 40 | | 1090 | 45 | | 890 | 50 | | 720 | 55 | |  |   Use the LOGO! Controller to create a program that turns ON a buzzer when the water temperature reaches a desired temperature. User should be able to adjust the required temperature in the range of 25-55 C.  Actual water temperature and desired water temperature should be displayed on the LOGO! Display unit.  Notes :  Temperature is inversely proportional to voltage.  Temperature shouldn’t exceed 55 C.  **Implement this control task using a heat bar, 2.4KΩ thermistor , 10KΩ potentiometer, buzzer, resistors, LOGO! Controller and LOGO! Soft comfort software**  Circuit is in the next page.   |  | | --- | | untitled.bmp |  |  | | --- | | IMG_0850.jpg |   **5.3 Prototype production line.**  A conveyer belt is used to move cans along the production line .Once a can reaches the filling area an inductive sensor will detect its presence and will stop the conveyer belt. At that moment the filling process starts.  Green light blinks five times (ON time= OFF time = 500ms) to indicate that filling in process. The conveyer belt resumes its motion after the can is filled.  Important notes:   * Selector switch I4 is used to turn ON the production line. * Operator should be able to determine the number of cans to be filled, after switching ON the production line; I3 is used to adjust the counter. * Counter cannot be adjusted while the production line is moving. * Conveyor belt starts moving when I1 is pressed. * An optical sensor at the end of the line is used to count the produced cans.   The conveyor belt will stop if any of the following occurs:   * The selector switch I4 switched OFF. * The number of filled cans reaches the operator settings.   Note: The number of desired cans and the number of produced cans should be displayed on the LOGO! Display unit.  **Implement this control task using the Edutariner kit and LOGO! Soft comfort software**  **5.4 Monitoring and controlling of filling a tank (simulation ONLY)**  A PLC program simulates a process tank being filled with a fluid. The tank will start filling (via a valve) whenever the start process button is enabled and the tank is not full. Indicator lights are activated when the tank level reaches 50%, 75% and 100% full.  If the tank for some reason does not fill up to a minimum level of 50% within 5 minutes after the valve energizes, an alarm will notify an operator. The operator will be able to silence the alarm for 5 minutes by pressing a silence button. After five minutes the alarm will trigger notifying the operator once again. If the tank remains under 50% full, “ERROR” message should be displayed on the LOGO! Display unit and the alarm can be switched OFF by switching OFF the overall system.  **Use the I/O list provided below to create the FBD for this control task and simulate your program.**   |  |  | | --- | --- | | **Inputs** | | | N.O Pushbutton (Start) | I1 | | N.C Pushbutton (Stop) | I2 | | N.C Silence pushbutton | I8 | | N.O Digital Level detector at 50% | I3 | | N.O Digital Level detector at 75% | I4 | | N.O Digital Level detector at 100% | I5 | | **Outputs** | | | Valve for filling | Q1 | | Alarm | Q2 | | Indicator light 50% | Q3 | | Indicator light 75% | Q4 | | Indicator light 100% | Q5 |   **5.5 Factory door (simulation ONLY)**  The entrance to a company’s premises is often closed with a gate. The gate is only opened to let vehicles in and out. The gate is controlled by the porter. Requirements for a gate control system:   * The gate is opened and closed by means of normally open pushbuttons in the gatehouse. * The gate motion can be interrupted and stopped at any time using a normally closed pushbutton. * An indicator lamp is switched ON five seconds before the gate starts moving and when the gate is in motion. * A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate is closing. * Limit switches are available at both ends.  |  | | --- | |  |   Create the FBD that solves this control problem  Note: use the circuit diagram and I/O list provided in the next page.  **Simulate and test your program.**   |  | | --- | | untitled.bmp |  |  |  | | --- | --- | | Inputs | | | N.O Pushbutton (S1) | I1 | | N.O Pushbutton (S2) | I2 | | N.C Pushbutton (S3) | I3 | | Limit switch (door open-S4) | I4 | | Limit switch (door close-S5) | I5 | | N.C safety pressure bar (S6) | I6 | | Outputs | | | Contactor relay (open) | Q1 | | Contactor relay (close) | Q2 | | Light indicator | Q3 | |